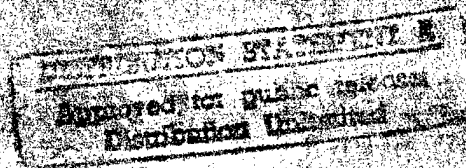


FINAL REPORT  
ENERGY ENGINEERING  
ANALYSIS PROGRAM  
FOR THE  
193d INFANTRY BRIGADE  
(P A N A M A)

ADMINISTERED BY  
MOBILE DISTRICT  
CORPS OF ENGINEERS

CONTRACT NO. DACA01-82-G-0118

EXECUTIVE SUMMARY



19971017 231

**HEERY**

Heery Energy Consultants, Inc.  
Atlanta, Georgia

With

Polzer, Narbona, Bond y Asociados, S.A., Panama, R.P.




DEPARTMENT OF THE ARMY  
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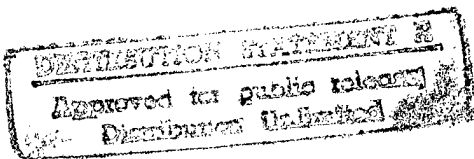
FOR THE  
  
193d INFANTRY BRIGADE

( P A N A M A )

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HEERY ENERGY CONSULTANTS, INC.  
ATLANTA, GEORGIA

With

HOLZER, NARBONA, BOND y ASOCIADOS, S.A., PANAMA, R.P.

## EXECUTIVE SUMMARY

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## I. INTRODUCTION

A 14-month long Energy Engineering Analysis Program (EEAP) has been conducted for the 193d Infantry Brigade. The EEAP identified nine ECIP Projects (Increment A and Increment B), four non-ECIP Projects (Increment G) and fourteen Facility Engineer Energy Conservation Measures (Increment F). Five of the nine ECIP Projects were expedited for submission in June 1983 for funding in FY 86. One of the ECIP Projects is for DODDS. Twenty other Energy Conservation Measures were investigated, but not recommended.

A two-volume Final Report was prepared in October 1983 and six copies delivered to the Installation. Two copies went to FORSCOM and other copies to the Corps Panama Area Engineer, District Engineer, Huntsville Division Engineer, South Atlantic Division Engineer and others. Volume I is Narrative and Supporting Data and Volume II is Project Documentation.

For the 15 recommended Projects, complete programming documentation has been prepared. If all 13 were implemented, the Brigade's total energy consumption (electricity plus DFM) would be reduced by 14 percent and the Brigade would save about \$3,200,000 a year. Implementation of the Increment F items would save an additional \$164,000 yearly. A prioritized list of energy conservation measures appears later in this Executive Summary. It is important to note that many of the recommended energy conservation measures also qualify for PCIP and QRIP funding and should be simultaneously submitted for funding under these programs.

## II. SUMMARY OF RECOMMENDATIONS

1. Submit the 13 Projects for funding.
2. For these which are eligible, also submit for PCIP and QRIP funding.
3. Implement the Increment F energy conservation measures according to priority.
4. Enforce Army regulations for water and space temperature setpoints.
5. Purchase only 34 watt F40 fluorescent tubes for use basewide.
6. Conduct an electrical load study.
7. Conduct a waste fuel incinerator feasibility study.
8. Look for additional applications of the technologies, such as two-speed motors, developed in the 13 Projects.
9. Look for additional applications for FM Control Switches.

10. Cease the use of window a/c units in remodeling and use more efficient centralized systems. Develop a program to gradually convert spaces with window units to central systems.
11. Standardize on high-efficiency or two-speed motors in new design.
12. Utilize more task lighting and less general lighting.
13. Cease the retrofitting of skylights in maintenance and warehousing facilities unless an installed cost of under \$2 a square foot can be expected.
14. Do not buy any more double-glazed windows for retrofit in Panama. Tight-fitting single-glazed windows are more cost-effective.

### III. PROJECT APPROACH

This project is a Modified Energy Engineering Analysis Program (EEAP) for the U.S. Army Defense Sites in the Panama Canal Area for the 193d Infantry Brigade. It operates under a Scope of Work which is modified from the usual EEAP in that its primary focus is on the development of energy projects and the preparation of associated documentation for the Brigade. In addition, rather than being a basewide energy study its scope is limited to those buildings enumerated in a Prioritized List which was made a part of the Scope of Work.

The Prioritized List contains 1480 buildings covering 12,646,000 square feet. It was prepared by Brigade personnel and was based on energy consumption so that all the large energy users are included. Low energy use buildings, substandard housing, remote facilities, and buildings to be turned over in the near future to the Republic of Panama were excluded.

The starting point for planning of the site survey was utilization of suggestions from the Engineering Instructions for Preparation of a Basewide Energy Systems Plan (January 1980 Draft Final Report). The initial selection of buildings to be surveyed was based on information obtained during a preliminary tour during March 1982 and from the Brigade's building information schedules.

This initial selection of buildings was modified considerably during the conduct of the first Site Survey in November 1982. The buildings selected for survey were closely coordinated with the FE's office so that the survey mirrors their concerns, problems, and priorities.

The categories, the number of buildings surveyed in each category, and the number of square feet surveyed in each category are shown below:

<u>Category</u>	<u>No. of Bldgs. Surveyed</u>	<u>No. of Sq. Ft. Surveyed</u>
Administrative	3	417,500
Barracks	8	289,800
Community Service	19	430,000
Family Housing	42	209,900
Hospital and Medical	10	457,800
Schools	22	831,200
Maintenance and Production	21	123,900
Operations and Training	6	251,800
Utility	3	4,700
Warehouses	7	502,700
Other	7	210,100
	<u>148</u>	<u>3,729,000</u>

#### IV. FINDINGS AND RECOMMENDATIONS

##### A. Existing Energy Consumption

The following table displays estimated annual energy consumption for the Brigade as a whole. These data were based on actual bills.

Certain assumptions were necessary. One in particular was that since DFM is accounted for only in terms of issues or purchases, not consumption, Heery assumed that over a period of twelve consecutive months the purchases would average out to approximate the consumption. Other assumptions are footnoted in the tables.

Two pie charts are also contained herein to illustrate annual energy consumption by installation and by building category. Both pie charts employ source energy data at 11,600 BTU/KWH.

It is seen that Family Housing, Barracks, and Administration are the three categories consuming the most energy. Accordingly, Heery surveyed more buildings (36%) in these categories than in others and identified more energy conservation measures (89%) applicable to these categories than to others.

## ANNUAL ENERGY CONSUMPTION, FY 1982

## SUMMARY

(1)

INSTALLATION	ELECTRICITY		DFM		TOTAL MBTU	PERCENT
	KWH (000)	MBTU	GAL	MBTU		
FORT CLAYTON	71,694	244,620	155,000	21,500	266,120	29.3
COROZAL	25,329	88,230	55,570	7,710	95,940	10.6
FORT GULICK	23,320	79,570	69,040*	9,580	89,140	9.8
HOSPITALS (Gorgas, Coco Solo, & Corozal)	10,126	34,550	320,920	44,510	79,060	8.7
FORT DAVIS	19,297	65,840	45,720*	6,340	72,180	7.9
CURUNDU (Laundry & Bldg. 2057)	12,294	41,950	180,780	25,070	67,020	7.4
FORT KOBBE	17,291	59,000	54,680	7,580	66,580	7.3
SCHOOLS	17,481	59,640	N/A	0	59,640	6.7
QUARRY HTS. & ANCON	8,859	29,310	7,160**	990	30,300	3.3
FORT AMADOR	7,740	26,410	8,270	1,150	27,560	3.0
FORT SHERMAN	5,612	19,150	18,220*	2,530	21,670	2.4
BALBOA	3,790	12,930	N/A	0	12,930	1.4
COCOLI	3,711	12,660	N/A	0	12,660	1.3
HOWARD	2,565	8,750	N/A or 0	0	8,750	0.9
TOTAL	229,370	782,610	915,360	126,960	909,570	100

N/A - Not Available

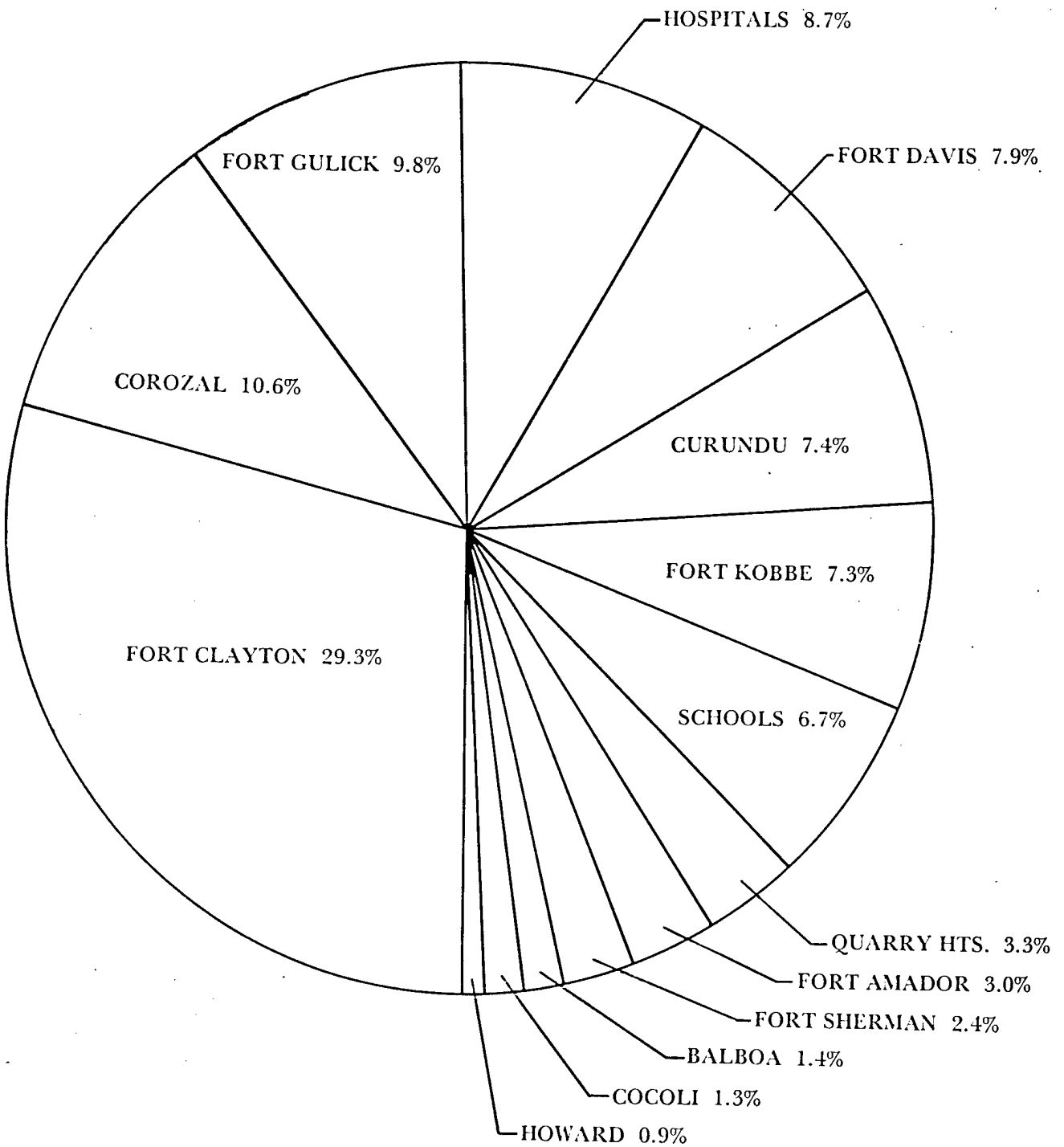
\* - A value of 0.040 Gals. DFM/Sq. Ft. was assumed based on available data from similar facilities.

\*\* - A value of 0.021 Gals. DFM/Sq. Ft. was assumed based on available data from similar facilities.

(1)

NOTE: The figures listed under the MBTU column are in terms of end-use energy, not source energy.





Brigade Energy Consumption for FY 82, based on electricity consumption and DFM purchases. Certain assumptions, explained in text, were made.

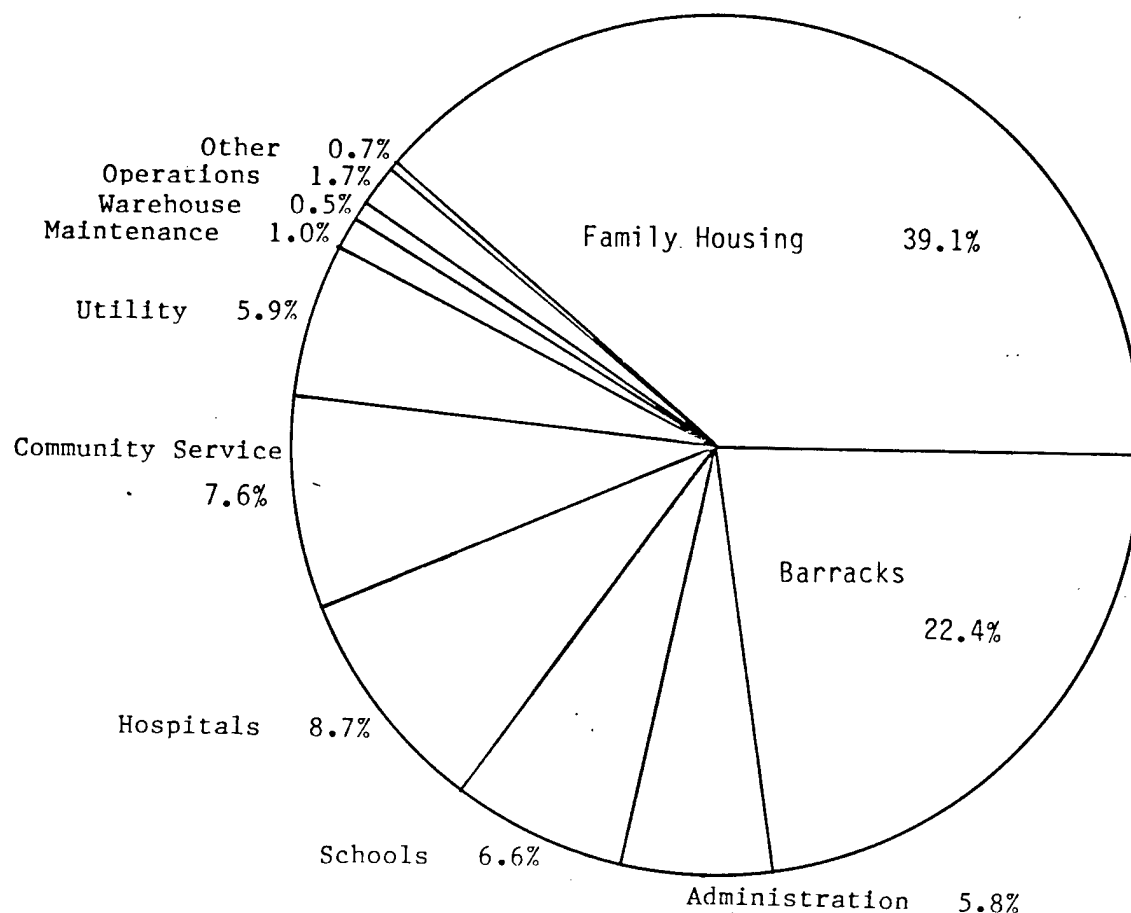


FIG. 2-2: Brigade Estimated Energy Consumption for FY82 by Building Category.

<u>Building Category</u>	<u>Consumption (BTU/GSF)</u>	<u>Floor Area (GSF)</u>	<u>Total Consumption (MBTU)</u>
Family Housing	244,700	4,940,900	1,209,095
Barracks	220,900	3,136,300	692,870
Administration	265,100	671,200	177,940
Schools	165,200	1,227,200	202,705
Hospitals	506,100	530,900	268,705
Community Service	339,900	693,900	235,840
Utility	N/A	N/A	182,910
Maintenance	51,000	584,600	29,805
Warehouse	34,000	278,100	9,450
Operations/Training	136,000	382,600	52,015
Other	150,500	200,000	30,105
<b>TOTAL</b>	<b>244,500</b>	<b>12,645,700</b>	<b>3,091,420</b>

Notes:

1. GSF = Gross square feet.
2. Total Consumption is in source MBTUs.
3. Floor areas drawn from Prioritized List. Does not include all Brigade properties.

## B) Energy Conservation Savings

At the Entry Interview of the Follow-Up Survey in March 1983, Heery was informed that energy conservation was receiving heightened attention at the Brigade because of a recent and sudden jump in electric billings. For several years, electrical consumption had been fairly stable at the level of about 20 million kilowatt hours per month. In February, the metered consumption rose to over 22 million kilowatt hours. This ten percent increase was unexpected and underbudgeted for and the Brigade was concerned about its ability to pay the resulting bill. Because of this increase, Heery was requested to develop a list of actions which the Brigade could quickly implement to bring the energy bills back into line. The "quick fix" items which were presented and discussed during the Exit Interview are listed below:

Action	Annual Dollar Savings
Standardize on 34-watt fluorescents instead of the 40-watt units now in use	\$ 260,000
Reduce DHW temperatures in family housing from an average of 150°F to 125°F	\$ 112,000
Reduce the DHW setpoint in barracks from an average of 150°F to 105°F	\$ 19,000
Reactivate 20 time clocks which have been tampered with	\$ 20,000
Raise chilled water temperatures in central chiller plants by 2°F	\$ 53,000
Close or block off outside air intakes in buildings where it is not necessary	\$ 15,000
Observe and enforce the setpoint of 78°F, per regulations, on air conditioning thermostats	\$1,700,000
At Ft. Clayton chiller plant, cycle off one chiller for 2 days, then on the 3rd day	\$ 41,000
Photocell control of security lights in CZ561	\$ 2,000
Photocell control of perimeter lights in Balboa High School	\$ 6,000

The total savings possible if these measures were implemented was estimated to be 2.2 million kilowatt-hours, or an annual savings of \$2,228,000 under the current electrical structure. If implemented these measures would reduce the Brigade's electrical energy consumption to below the previous baseline average.

A review meeting for Phase I was held in Atlanta in March and a Phase II Report focusing on suggested Projects was submitted in June, 1983. In addition, programming documentation for five projects was expedited to meet the Army's deadlines for FY 86 ECIP funding. These were submitted May 6, 1983. The Phase II Review Meeting was held in Panama, June 28th. Discussions at this meeting led to the elimination of some Projects, the combination of others and the creation of one new Project. The final Project List as recommended by Heery is shown below:

# PROJECT LIST

<u>Project Name</u>	<u>Heery Project Number</u>	<u>Army Project Number</u>	<u>SIR</u>	<u>ESC CWE</u>	<u>MBTU/ YR Saved</u>	<u>Eco- nomic Rank</u>	<u>Comments</u>
2-Speed Motors, Barracks	T-1	T-100	4.30	503,700	18,050	11	Increment A
2-Speed Motors, Other Buildings	T-2	T-101	5.57	265,800	12,302	9	Increment A
Timer Switches	T-3		-	-	-	-	Increment F
Boiler Plant Modifications	T-4/5		-	-	-	-	Eliminated
Turbulators	T-6		-	-	-	-	Eliminated
CHW Pipe Insulation	T-7		3.49	15,400	447	12	Increment G
Brine Pipe Insulation	T-8		-	-	-	-	Eliminated
Reflective Window Film	T-9		4.41	204,500	9,713	10	Increment A
Outside Air Shutdown	T-10	T-101	-	-	-	-	Combined w/T-2

Project Name	Heery Project Number	Army Project Number	SIR	ESC CWE	MBTU/ YR Saved	Eco- nomic Rank	Comments
Chiller Optimizer Controls	T-11	T-102	7.38	489,300	30,114	6	Increment A
Chiller Interlock	T-12		-	-	-	-	Increment F
Variable Speed Pumping	T-13	T-102	-	-	-	-	Combined w/T-11
Convert Gorgas Hospital to VAV	T-14		-	-	-	-	Eliminated
FM Controls	T-15	T-103	9.17	1,137,900	92,545	4	Increment B
Outdoor Lighting Conversions	T-16		-	-	-	-	Increment F
Indoor Lighting Conversions	T-17		-	-	-	-	Increment F
New Cooling Tower	T-18		1.98	12,600	207	13	Increment G
Weatherization, Family Housing	T-19	T-104	9.47	1,287,300	101,120	3	Increment A
Photocell Control of Lighting	T-20		-	-	-	-	Increment F
Low Flow Shower Heads	T-21		-	-	-	-	Increment F
Insulate Water Heaters & Piping in Family Housing	T-22	T-104	-	-	-	-	Combined w/T-19
Water Heating Heat Pumps in Family Housing	T-23		-	-	-	-	Eliminated
Water Heating Heat Pumps in Barracks	T-24		-	-	-	-	Eliminated
Thermostat Covers in Family Housing	T-25		27.98	329,800	76,581	2	Increment A
FC95 Chiller Consolidation	T-26	T-102	-	-	-	-	Combined w/T-11

<u>Project Name</u>	<u>Heery Project Number</u>	<u>Army Project Number</u>	<u>SIR</u>	<u>ESC CWE</u>	<u>MBTU/ YR Saved</u>	<u>Eco- nomic Rank</u>	<u>Comments</u>
Insulate Water Heaters, Out- side, FH	T-27	T-104	-	-	-	-	Combined w/T-19
FC519 Chiller Consolidation	T-28	T-102	-	-	-	-	Combined w/T-11
Condenser Replace- ment CZ300	T-29		5.85	93,600	4,548	8	Increment G
School Energy Projects	T-30		8.42	211,000	14,715	5	Increment A
Heat Recovery Water Heaters	T-31		6.10	1,141,400	62,263	7	Increment A
Thermostat Covers	T-32		52.44	37,790	16,443	1	Increment G
TOTALS			9.0	5,730,200	439,048		

In addition to Projects, a broad variety of FE Energy Conservation Measures were investigated and are broken into two categories: specific and general. The specific measures are described and analyzed in some detail in the Report. The general measures are merely listed therein as items for action.

The specific measures are:

1. Fluorescent lighting alternatives
2. Photocell control of unnecessary lighting
3. Exterior lighting conversions
4. Interior lighting conversions
5. Timer switches on lighting circuits
6. Insulate chilled water lines in the Commissary
7. Water treatment for chiller condensers
8. Remove inactive reheat coils
9. Reduce outside air from infiltration
10. Reduce outside air via AHU's
11. Negative space pressurization
12. Replace standard motors with energy-efficient ones
13. Interlock ancillary equipment with chillers
14. Flow restrictor shower heads and sink faucet aerators

The recurring general measures are:

1. Install filters
2. Replace filters
3. Replace broken glass

4. Repair water leaks
5. Replace fan belts
6. Reset water temperatures
7. Repair insulation
8. Weatherstrip
9. Caulk

Each Increment F item was analyzed for projected annual energy savings and anticipated implementation cost. They were then compared based on the length of simple payback periods and are listed below in order of recommended implementation.

<u>Rank</u>	<u>Project Description</u>	<u>Annual Energy Savings (MBTU/yr)</u>	<u>Annual Cost Savings (\$/yr)</u>	<u>Simple Payback (yrs)</u>
1.	F-13, Interlock Ancillary Equipment with Chillers	563.2	13,900	0.02
2.	F-14, Install Water Flow Restrictors	15,250	123,660	0.4
3.	F-7, Water Treatment for Condensers	654.5 <sup>1</sup>	10,320 <sup>1</sup>	0.4
4.	F-1, Fluorescent Lighting Alternatives	30.0 <sup>2</sup>	2.52 <sup>2</sup>	0.7
5.	F-5, Timer Switches on Lighting Circuits	5.5 <sup>1</sup>	40 <sup>1</sup>	1.0
6.	F-8, Remove Inactive Reheat Coils	2.0 <sup>3</sup>	50 <sup>3</sup>	1.2
7.	F-12, Install High-Efficiency Motors	24.2	231	1.9
8.	Implement the following outdoor air reduction strategies at same time	107.7 <sup>3</sup>	2,650 <sup>3</sup>	2.2
	F-9, Infiltration	-	-	-
	F-10, AHU Intake	-	-	-
	F-11, Negative Pressure	-	-	-

<u>Rank</u>	<u>Project Description</u>	<u>Annual Energy Savings (MBTU/yr)</u>	<u>Annual Cost Savings (\$/yr)</u>	<u>Simple Payback (yrs)</u>
9.	F-6, Insulate Chilled Water Lines	14.7	106 <sup>1</sup>	3.2
10.	F-4, Interior Lighting Conversions	1,702 <sup>4</sup>	12,880 <sup>4</sup>	4.4
11.	F-2, Photocell Controls	16.3	118	6.0
		<hr/>	<hr/>	<hr/>
		18,370	163,958	0.7

<sup>1</sup>Example results which can be applied to other locations throughout the installation.

<sup>2</sup>Per Lamp.

<sup>3</sup>Per 1,000 CFM.

<sup>4</sup>Based on implementation at all locations listed in table under project description.

Not recommended was F-3, Exterior Lighting Conversions which had a payback of 7.6 years.



A comprehensive list of all energy conserving measures of all the Increments Heery recommends for implementation follows. In this list, SIR numbers have been converted to "years payback" and the Projects are ranked together with Increment F measures. It is interesting to note that seven of the top ten are Increment F measures.

The combined payback for all of the ECM's is 1.4 years. This was calculated as a weighted average based on the contribution of each ECM to overall energy savings.

#### COMPREHENSIVE ECM LIST

<u>RANK</u>	<u>ECM NUMBER</u>	<u>DESCRIPTION</u>	<u>SIR</u>	<u>SIMPLE PAYBACK (YEARS)</u>
1.	F-13	Interlock Auxiliary Equipment with Chillers	669.	0.02
2.	T-32	Tamperproof Thermostat Covers	52.44	0.3
3.	F-14	Install Water Flow Restrictors	33.45	0.4
4.	F-7	Water Treatment for Condensers	33.45	0.4
5.	T-25	Thermostat Covers in Family Housing	27.98	0.5
6.	F-1	Fluorescent Lighting Alternatives	19.11	0.7
7.	F-5	Timer Switches on Lighting Circuits	13.38	1.0
8.	F-8	Remove Inactive Reheat Coils	11.15	1.2
9.	T-104	Weatherization in Family Housing	9.47	1.4
10.	T-103	FM Controls	9.17	1.4
11.	T-30	School Energy Projects	8.42	1.6
12.	T-102	HVAC	7.38	1.8
13.	F-12	Install High Efficiency Motors	7.07	1.9
14.	T-31	Heat Recovery Water Heaters	6.10	2.2
15.	F-9,10,11	OA Reduction Strategies	6.08	2.2
16.	T-29	Condenser Replacement in CZ 300	5.85	2.3
17.	T-101	Two-Speed Motors	5.57	2.4
18.	T-9	Reflective Window Film	4.41	3.0
19.	T-100	Two-Speed Motors in Barracks	4.30	3.1
20.	F-6	Insulate Chilled Water Lines	4.18	3.2
21.	T-7	CHW Pipe Insulation	3.49	3.8
22.	F-4	Interior Lighting Conversions	3.04	4.4
23.	F-2	Photocell Controls	2.23	6.0
24.	T-18	New Cooling Tower	1.98	6.7
			<u>9.3</u>	<u>1.4</u>

Other ECOs were investigated but not recommended for various reasons. A summary listing of these and their disposition, with temporary project numbers which had been used in some cases, appears below:

<u>ECO Name</u>	<u>Investigation Outcome</u>
Boiler Plant Modifications T-4/5	Eliminated-due to high first cost and relatively low savings.
Turbulators T-6	Eliminated-due to impending replacement of boilers in question.
Brine Pipe Insulation T-8	Eliminated - due to a piping insulation project having been commenced.
Convert Gorgas Hospital to VAV T-14	Eliminated - due to Panama Canal Commission Mechanical Maintenance Department rejection.
Outdoor Lighting Conversions T-16	Eliminated - due to its unfavorable payback period.
Water Heating Heat Pumps in Family Housing T-23	Eliminated - due to high maintenance costs.
Water Heating Heat Pumps in Barracks T-24	Eliminated - due to high maintenance costs.
Fabric Domes	Eliminated - due to extremely high first cost with little savings possible.
Conversion from Window A/C to Central A/C at Gorgas 238	Eliminated - due to the cost of purchased chilled water being more than electricity for this building.
Add Return Air Capability	Eliminated - no economic savings realizable due to the chilled water contract being based upon installed capacity.
Chemical Dehumidification	Eliminated - no economic savings realizable at Gorgas Hospital complex due to the chilled water contract being based upon installed tonnage.

<u>ECO Name</u>	<u>Investigation Outcome</u>
Pre-cool Supply Air with Exhaust Air	Eliminated - no economic savings realizable at Gorgas Hospital complex due to the chilled water contract being based upon installed tonnage.
Chilled Brush Cleaning	Eliminated - due to high first cost and uncertain savings.
Roof-Spray Cooling System	Eliminated - due to the roof age and pitch as well as the limited water supply.
Conversion to LPG	Eliminated - due to little or no savings possible.
Double Glazed Windows	Eliminated - due to its very high payback period.
Nighttime Set-Up Thermostats	Eliminated - due to the possibility of mold and mildew formation when the fans are turned off.
Cold Storage Plant AHUs	Eliminated - due to very high payback period.
Heat Reclaim in the Laundry	Eliminated - due to its unfavorable payback period.
Screw Type Chillers	Eliminated - due to the energy savings not being large enough to justify the cost of a complete changeout on an otherwise serviceable chiller.

## CONCLUSION

If all thirteen Projects are implemented, as is recommended, the Brigade will realize a savings of 439,048 million BTU's of source energy annually. This savings is entirely electrical and represents a monetary savings of about \$3,200,000 at current rates. The recommended measures from Increment F would save an additional 18,370 million BTU's a year, or about \$164,000 annually. The Brigade's electric bills fluctuate but average nearly 20 million KWH a month. At \$.084/KWH, the savings identified above could reduce the Brigade's electric bill by 17 percent. The Brigade's total energy consumption (electricity plus DFM purchases) would be reduced by 14 percent.

PHASE III MEETING  
123d Infantry Brigade, PANAMA  
September 20, 1983

The Review Meeting for the Draft Final Report of the EEAP was conducted at the office of the Directorate of Engineering and Housing, 193d Infantry Brigade, in Panama. Attending the meeting were:

John Hannaman	193d DEH
Enrique Diaz	193d DEH
Raul Irigoyen	193d DEH
Clarence McMurray	193d DEH
Edilma deBurgos	DODDS
S. J. Shaw	DODDS
H. Ray Davis	COE SAD
Van Mizzell	COE Mobile
Barney Shull	COE Mobile
Richard Holzer	Holzer, Narbana, Bond y Asociados, S.A.
Joseph Bond	Holzer, Narbana, Bond y Asociados, S.A.
Mike Sherber	Heery Energy Consultants, Inc.
Glenn Jardine	Heery Energy Consultants, Inc.
Wayne Robertson	Heery Energy Consultants, Inc.

Mr. Shull opened the meeting. He remarked that this was the draft final submittal by the architect-engineer and that all reviewing and commenting was to be performed at today's meeting. At the conclusion of the meeting, Mr. Shull would declare the comment period to be closed and Heery would not be required to accept or respond to any comments received after this date. Mr. Shull explained that the order of the business would be to hear a presentation by Heery of the Draft Final Report, followed by the hearing of comments, either written or verbal, from the Installation and each of the Reviewing Authorities present, concluding with a reading by the Mobile District Office of comments submitted by others who were absent and finally, a presentation of the comments of the Mobile District Office.

Mr. Wayne Robertson, representing Heery, summarized the highlights of the Draft Final Report and pointed out some of the changes made between the preparation of the Phase II Report, submitted in June, and the preparation of this report submitted in September. The most important changes were that two new projects had been created. One was a heat recovery water heater project, T-31, which was developed in order to replace the heat pump water heater project that had been eliminated due to a projection of maintenance costs which were thought to be excessively high. The other new project is T-30, entitled School Energy Projects. This is not truly a new project but instead is a collection of all the sub-elements of other energy projects which

affected DODDS schools. This was necessary because previously school buildings had been previously grouped with other buildings in the various energy conservation projects which Heery had developed. However, since DODDS schools are facilities whose energy expenses were reimbursed to the U.S. Army, they had to be separated from strictly U.S. Army properties where the installation paid the utility bills. Therefore, those sub-projects which involved DODDS school properties were pulled out of their original projects and regrouped into a single overall school energy project, T-30.

Outside of this, there were no other significant changes between the Phase II Report and the Draft Final Report. Heery's activities of the past ninety days were principally concerned with refining and polishing the information contained in the Phase II Report, rather than the creation of any new or additional data. Section 8 which deals with Increment F, was entirely rewritten, which should cause it to be an information resource that will be of greater use to the Installation. Also, completely rewritten were the Project Back-Up Data Sections of each of the thirteen projects. In the Phase II submittal, most of the Project Back-Up Data sections had been written by several different individuals and there was a lack of continuity and flow from one part to another. In addition, the Project Back-Up Data sections for different projects were not in the same format. All these have been totally rewritten and are organized along the lines of a consistent, logical format. Each PBUD now begins with a statement of the problem to be solved; followed by a brief discussion of possible alternatives; next followed by a statement of recommended solutions; then comes the computations and calculations; and last comes a savings summary.

Heery believes that this new format will make the projects much more understandable and will create a good audit trail in the event that some of these projects are not implemented for several years and that it later becomes necessary to re-validate the savings computations.

Next, Mr. Robertson explained that this Draft Final Report was placed in a loose-leaf binder so that after corrections and comments from the Reviewing Authorities are incorporated into the Final Report, it will be necessary to distribute only the corrected sheets to the holders of this report. This will avoid the reprinting of an entirely new report only to correct a few dozen pages. When Heery distributes the corrected sheets to make up the Final Report, new covers will also be distributed for insertion by the report holders.

During the period between the distribution of the Draft Final Report and this review meeting, Heery uncovered a number of errors and misprints for which corrected sheets had been prepared. These corrected sheets were distributed at the review meeting and answered a

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number of the comments which reviewers had made. Also, distributed at the meeting was the Executive Summary which had not been submitted with Draft Final Report. The Executive Summary, being 63 pages long, was thought to be too lengthy and Heery was requested to condense it to about 20 pages or less.

At the conclusion of Heery's presentation, comments from those present were next received, beginning with the Installation personnel. Raul Irigoyen was generally complimentary about the Report and especially in connection with Section 8, the FE Measures. He stated that he thought this section would be a most useful tool to the Installation and that several of the actions Heery suggested are already being undertaken. Mr. Irigoyen also expressed a need for some technical assistance concerning the FM Controls Test that the Installation is presently implementing. He was troubled by a statement by the local Motorola representative that even though the computer can generate hundreds or thousands of codes the transmitter to handle only 20 simultaneously and could be expanded up to forty. He thought that this would be severely limiting and asked Heery to speak with our stateside Motorola contacts for an explanation. His second problem with the FM controls tests was that the switches were reacting to radio interference. He stated that stray signals from sources such as amateur radio operators were causing the chips to switch off or on even though the control module had not yet been installed. Heery agreed to look into both of these matters and offer him some suggestions on how to deal with them.

Next came some comments from Enrique Diaz. Mr. Diaz pointed out that two buildings had been left off of Project T-104 and these were Curundu 2323 and Cocoli 2526, for attic insulation. Also, he remarked that in Sections 2 and 4 of the Report the phrase "Canal Zone" had been used when "Canal Area" is more proper and that "Panama Canal Company" had been used which should read "Panama Canal Commission". Heery will correct both of these items in the Final Report.

Next, comments from SAD and from the Mobile District Office were read into the record. These comments had been prepared in writing and are separately submitted, along with Heery's responses to these Minutes.

As the Executive Summary had not been seen by any Reviewing Authority before the Review Meeting, a break was called for those present to examine the Executive Summary and later reconvene to make their comments. The principal comments were that it was too lengthy and that it should appear both as a separately bound document and bound in with Volume 1 of the Final Report. Heery will edit the Executive Summary down to size and provide copies as required by the Scope of Work.

After methods of condensing the Executive Summary were suggested by those present, Mr. Shull closed the Meeting by giving Heery the authority to proceed to the Final Report.

This concludes the Minutes of the Review Meeting of September 20, 1983.